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Combat Crew

strategic air command

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AUGUST 1978

THE EDGE IN THE STRATEGIC BALANCE

Lt Gen Richard L. Lawson
Director for Plans and Policy
Organization of the JCS

In terms of people, air bases, and aircraft, this is the leanest Air Force in nearly 30 years. In the past 15 years, our active duty manpower has decreased by 33 percent; we have closed 82 major Air Force installations; and have reduced our active aircraft inventory by approximately 6,000 aircraft. Soviet military strength, in comparison, has continued to grow impressively. Many defense analysts presently suggest that the Soviet Union has achieved a "rough equivalence" or "parity" with United States strategic forces. For the immediate future however, I believe that the United States still has the edge over the Soviets. That edge is the dedicated and demonstrated capability of the men and women of SAC. That edge is all of you.

During the course of my career, I've had the opportunity to spend approximately five months in the Soviet Union in preparation for various high level negotiation discussions. After my military hosts had completed the normal amenities of a foreign visit, one of the first questions they invariably asked was: "What makes the people of the Strategic Air Command perform the way they do?" They wanted to know if SAC personnel received special pay, were allowed special privileges, or provided special dispensations and/or facilities to perform their mission. I responded that SAC people were treated no different than anyone else. To someone who has grown up in the closed Soviet system, this was inconceivable. To someone who does not understand the concept of individual freedom as Americans daily experience and cherish it, it was difficult to explain why SAC people do what they do — 24 hours a day.

I relate this story to suggest that we, in the Strategic Air Command have a deeper commitment to our profession than any definition of occupation. It is that "calling" — that raison d'etre for being — that drives us to excel. Recognizing that the next few years will not see our weaponry replaced, it

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must be our professionalism — our dedication to mission performance — that makes the difference. It is that "professionalism" that I would like to address in this article.

To my way of thinking, professionalism is actually a deep and all-encompassing personal life style decision, not an emotion or a temporary state of mind. One has to literally make a mental commitment to be professional in the performance of every obligation. The development of the mental toughness required to achieve professional performance dictates the maximum use of talent, initiative, energy, and instinct. Most of all, each of us needs to examine our own professional attitude to identify strengths and weaknesses within ourselves. Let me suggest some approaches you may want to use to begin your personal assessment.

Examine, first, how your own professionalism is projected into your work. The aircraft we fly and the missiles we operate are aging. The hours we are called to work are sometimes inconvenient. Duty away from the family is frequently endured. Each of these demands are different from the civilian world, but our profession as guardians of America has a purpose transcending individual self-interest. It has been handed down from generation to generation as a dynamic outgrowth of our constitutional origin. Do you have the mental attitude to cope with the adversities of your job because you believe in the "calling?" Do you pause to reflect upon the importance of your mission and your part in its accomplishment? Do you demand as much from yourself as you demand from others? Do you accomplish your job the way you would want the next person to do it? Are you as "mentally tough" as self-evaluation will allow? The answers to these questions are important to the professional.

Once you have completed an objective evaluation of your professional attitude, observe those who work around you. They will probably mirror your performance. If you maintain high standards, they will strive to achieve high standards. If you are loose

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Combat Crew

Magazine of the Strategic Air Command - 29th Year of Publication

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ON OUR COVER

Crowded skies can sometimes create problems for SAC aircraft. For more on this study, see page 4.

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DANGER AREA — LOOK OUT!

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Capt William C. Kassen
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Midair collisions are an area of great concern in aviation safety. They are unlike other types of aircraft accidents in that in almost 50 percent of all cases, there is at least one death.

With the sky becoming more and more crowded with aircraft flying at higher speeds, it is conceivable that the problem of preventing midair collisions will be worse in the future. The most often probable cause of the midair collision cited by the National Transportation Safety Board is "pilot in command failed to see and avoid other aircraft." The speeds of aircraft today strain our see and avoid procedures to the limit.

Midair collisions occur generally during daylight hours. Fifty-six percent of the accidents occurred in the afternoon, 32% in the morning, with the remaining 12% occurring at night, dusk and dawn. Most occurred in weather conditions when the visibility was acceptable; i.e. three miles or more.

The average flight time prior to the collision is 45 minutes. However, this time varies from takeoff to over seven hours. Sixty percent of these pilots on the fateful flight had been airborne 30 minutes or less. In fact 33% had been up only 10 minutes or less. Eighty percent had been up one hour or less. Only

6% had been flying longer than two hours.

It would appear that fatigue is not a major factor in midair collisions, at least fatigue from the flights that the accident occurred. However, this does not eliminate the possibility of the pilot being fatigued prior to takeoff.

Let's take a look at some of the techniques for preventing two aircraft from trying to occupy the same space at the same time.

DETECTION

The detection of an airborne object depends on six conditions: (1) image size — the portion of the visual field filled by the object; (2) luminance — the amount of brightness of the object; (3) contrast — the difference between object and background brightness, color, and shape; (4) adaptation — the degree to which the eyes have adjusted to surrounding illumination; (5) motion — the velocity of the object, the observer, or both; (6) exposure time — the length of time the object is exposed to view.

IMAGE SIZE

An aircraft seen at a long range appears not as an identifiable shape but rather as a dark dot. Aircraft detection is different under conditions of day and night vision. During the day, the further from the fovea (center of vision), the object falls, the larger the images must be in order to be noticed. At night, on the other hand, detection is sometimes superior if, the target image falls on the peripheral retina, (off center), rather than the fovea. The well-known phenomenon of a dim light disappearing when the observer looks directly at it and reappearing when he looks slightly to the side of it shows this.

LUMINANCE AND CONTRAST

Luminance and contrast are basically one and the same. An object will be visible then, only when it is sufficiently brighter or darker than its background — when, in other words, there is enough contrast.

In addition to brightness, contrast, color and shape differences offer clues to the presence of aircraft. When object and background are contemporary colors (yellow and blue, green and red, black and white), detection becomes easier. Similarly, when objects are long and thin as opposed to round and flat, they are easier to detect. An aircraft seen longside ( ) is easier to notice than a head-on aircraft of equal area ( ).

ADAPTION

The eye requires at least 30 minutes, but sometimes much longer, in darkness to regenerate visual purple so that the eye can distinguish objects under low illumination. Conversely, when the eyes have been accustomed to darkness, they need time to adapt to bright light.

MOTION

Against a stationary irregular background, an aircraft needs only to move a few minutes of arc per second to reveal its presence to an alert observer. Against a featureless background, like a cloudless blue sky, however, the aircraft's perceived motion must be 10 times faster to be noticed. What complicates the detection of relative motion is the fact that the eyes themselves are constantly moving.

EXPOSURE TIME

An aircraft that darts in and out of clouds presents a special challenge to the viewer. When an aircraft is not continuously exposed to view, the pilot has to judge its speed and direction in order to follow its path behind cloud or horizon. A small, slow-moving object that presents little contrast against its background can be easily lost during intermittent observation.

As they become fatigued, a person's eyes grow less efficient at the task of seeing airborne aircraft. Only well rested eyes can ensure good vision.

Structural parts, windshield/canopy distortion, poor cockpit lighting, and instrument glare can limit a pilot's vision. Make your windshield spotless.

Total darkness, fog, total overcast, and cloudless blue skies, all present the viewer with a monotonous field. In such conditions, normal eyes constantly try to focus on infinity by actually focusing on a point 1 to 2 meters away. This is called search myopia and reduces the pilot's chances of seeing a distant aircraft.

Try to focus on objects at the maximum range you expect to see aircraft — focus on the ground at about 4 to 8NM and move your gaze up to the sector of the sky to be searched. Avoid, as much as possible, frequent refocusing in and out of the cockpit.

About 1/3 of a second is required for the eye to focus at each fixation. Your airborne searching scan should be slow and methodical. Learn to scan the visual field by dividing the area up into sectors, about 30 degrees each. Fix your gaze in that sector for a second or two. Investigate any movement, then move to the next sector. If you have trouble focusing at long ranges, try squinting. Squinting compresses the eyeball and changes its focal length, making long-range aircraft come into focus.

At lower altitudes the easiest aircraft to see is on the horizon. Shadows sometimes help pilots to detect another aircraft. To spot the aircraft, look from the shadow to the sun. The lower the aircraft is the closer it will be to its shadow.

RADAR

Radar myth and conception; the airman's concept of radar and what it can and cannot do for them.

The continuing development of more sophisticated and automated equipment has given rise to the notion among some airmen that controllers are watching their every move enroute, and will always be able to warn other aircraft — particularly those flying IFR — of their presence. This is the misconception that can kill you.

The adoption of radar into air traffic control brought with it a series of increased capabilities. But the glowing wonders of each new radar or its added capabilities encourages some of us to overlook that fact that current radar is not all-encompassing in its coverage, does not pick up all aircraft at all times, and is primarily concerned with the separation of IFR traffic.

As radar found its way into air traffic control, ground clutter became an increasingly serious problem for terminal radar. Some of today's most sophisticated black box circuitry is aimed at reducing this phenomenon. Modern radar does a magnificent job compared to the old days, but clutter is still there. One way of reducing it to a minimum results in weakening radar's sensitivity to certain distant aircraft targets. The person affected in this trade-off is the airman flying an airplane whose radar-reflecting properties are weakest. This group includes many small general aviation airplanes flying IFR without active transponders. In some situations these aircraft are not "painted" on the radarscope, even though they are within range of the transmitter.

SECURITY BLANKET

Some pilots think of IFR as a security blanket. They say to themselves, "I'm on an IFR flight plan; therefore, the air traffic service is going to tell me about all the traffic I might encounter." So they settle back in their seat in imagined safety.

WHO IS RESPONSIBLE

The fact is that when operating in VFR conditions, regardless of flight plan, responsibility for seeing and avoiding other traffic rests with the pilot, not the controller. Civilian radar was developed primarily for the separation of IFR traffic from other IFR traffic. That is still the controller's prime responsibility, although he will also assist VFR traffic as much as time and facilities permit, calling the pilot's attention to any known potential problem or immediate hazard. Radar advisory service for aircraft is specifically designated as a duty that follows the priorities of separation, safety advisories, and other required controller actions, to be performed on a workload permitting basis only.

What about that VFR day when you were level at 4,500 — certainly high enough to be in coverage — and center missed telling you about the aircraft that nearly hit you? Traffic was light, so you know the controller should have had time to help you.

There are days when the weather is "good" for flying, but maybe not so good as far as radar is concerned. Wind, temperatures aloft (particularly when inversions are present), dew point spread, and clouds can all have effects on radar that produce clutter, or reduce radar efficiency. This may occur where you or your traffic is located. In addition the angle at which the radar antenna is tilted can result in some traffic not being seen at certain altitudes. Statistics show that the bulk of IFR traffic, the kind Center radar is primarily interested in, spends most of its time at relatively high altitudes while enroute. This is the traffic that the enroute radar is designed to monitor.

In terminal areas, the heavy traffic areas are within 30 miles of the airport at altitudes varying with the location; again, the radar is focused for the area of greatest use. At 40 miles out you are in all likelihood within range of the radar signals, but the controller's scope may only be displaying targets closer in. Another factor to keep in mind is that there is virtually always a cone of non-coverage directly overhead the radar antenna. All these things leave some rather wide open air spaces where there is no VFR radar coverage at many altitudes.

Certain kinds of general aviation aircraft are detected by radar with more difficulty than are others. Smaller airplanes; those made in great part of materials other than metal; aircraft without propellors; and slow moving craft all have less reflecting ability than others, resulting in less return of energy to the radar antenna. Consequently, the primary targets they produce are weak or often non-existent. An airplane also presents less of a target to the controller when it is flying directly toward, or directly away from, the radar antenna.

WEATHER RADAR

One of the current uses of radar, other than air traffic control, is in weather observation and forecasting, and weather returns tend to blot aircraft. True, controllers can lessen to some extent the strength of weather returns, but this ability is not absolute and often it is desirable to display weather for use when airman ask to be vectored around rough areas or storm cells. Other aircraft may be "wiped off the scope" by this display.

100 PERCENT CONCEPT

The concept of 100 percent radar coverage has to be understood in terms of stated goals, present and future. Questions put to FAA "Listening Sessions" reveal that some pilots believe any time they hear "Radar Contact" the controller has taken over all separation responsibilities. At the very least, these pilots believe all air traffic in the area is shown on the controller's scope. This assumption can be a fatal error. Radar does not protect from unidentified aircraft or those which may not be showing up clearly on the radar scope, such as VFR traffic that has entered into an IFR environment.

Radar advisories are an infinitely useful aid in helping the VFR pilot maintain his own separation, but they are not to be regarded or evidence that a controller has taken over responsibility for such separation.

INCREASE AVAILABLE PROTECTION

What can the airman do to increase the protection available for radar?

You can help the radar controller help you by not adding to his workload unnecessarily when he is in the process of identifying your target. Remember that he may be looking at many unidentified blips on his scope. Knowing where you are at all times simplifies the task of establishing radar contact — and shortens the time when you are present as an "unknown."

VFR and IFR flight use similar concepts. Maintaining IFR means adhering to IFR altitudes and airspeeds, while remaining within defined airspace, such as the enroute structure or terminal area and making the most of any traffic separation service available. When VFR, we still remain within certain airspeed, altitude and area perimeters, such as in the traffic pattern and VFR hemisphere altitude.

Aircraft operating in visual conditions under IFR should be aware that they are in a "see and avoid" environment. Separation is provided only from other known aircraft operating within controlled airspace.

Use extreme caution in terminal areas. This is where traffic density is greatest, and where the mix of IFR and VFR traffic creates the greatest hazard. Flying a practice instrument approach in VFR conditions is fine, but it's not the time to keep your eyes glued to the gauges. Even a radar monitor may not help; there are a lot of non-transponder equipped aircraft around that may not appear on the controller's scope. Don't get complacent, not even on final.

LISTEN

If you can't look, listen. Recent improvements in the U.S. air traffic control system such as the Conflict Alert System and transponder altitude readout have made life a little safer for everybody, but any system has flaws. In IMC, pay attention to the radios and keep up with the traffic situation in your area.

1968 FAA (NMAC) REPORT

The 1968 FAA Near Midair Collision (NMAC) Report established that the majority of the 2230 NMAC reports investigated were found to have occurred within the terminal airspace environment. Military aircraft were involved in 27% of all incidents, air carriers 30%, and general aviation 43%. Within the terminal airspace, 30% of the NMAC occurred within 5NM at or below 3500 feet AGL, and 97% within 30 NM at or below 8000 feet AGL.

Nearly half of the incidents involved an aircraft approaching the airport in climb or descent altitude encountering another aircraft in level flight. The second aircraft was generally unknown to any control agency. Although one aircraft was generally operating on an IFR flight plan, both were usually in VFR conditions.

Within enroute airspace, 67% of the NMAC occurred below 10,000 feet MSL. Nearly 40% of the total were within 10 miles of a NAVAID. This converging situation is considered the most significant factor in nature, in the enroute airspace.

Although general in nature the following list identifies the human, equipment and environment sources of near midair collisions:

1. Human factors.
2. Aircraft Mix — IFR/VFR.
3. See and Avoid.
4. Communications.
5. Airport Location.
6. Airspace Utilization.
7. Lack of collision Avoidance System.

Increased radar advisory service may reduce the airman's motivation to keep a "lookout" and

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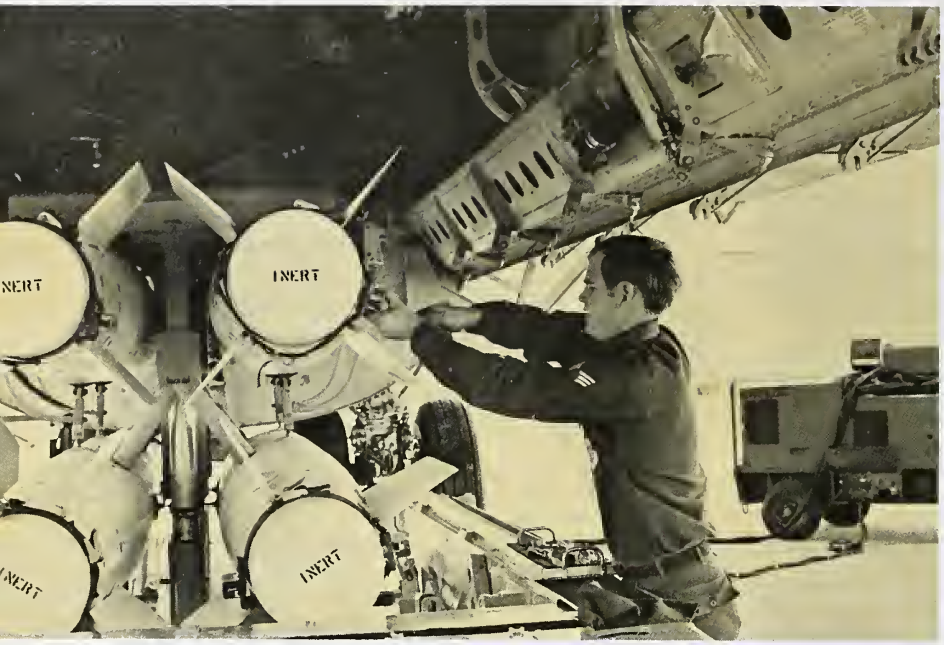
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GIANT SWORD '78

GIANT SWORD, SAC's 1978 Munitions Loading Competition, will be held August 14-23 at Ellsworth AFB. Each of SAC's 20 bomb wings will be represented by a competition team composed of a five-person munitions load crew, an aircraft crew chief, a six-member security police element and a team officer and noncommissioned officer.

No actual weapons will be loaded. Using training devices only, each munitions crew will be required to upload two different classes of weapons: a gravity weapon, and either a short range attack missile or aerial mines.

The competition is designed to enhance esprit de corps, promote a competitive spirit among units, improve loading proficiency and security police skills, and aid in the evolution of new concepts.

Munitions loading will be accomplished on four types of aircraft: a B-52D, G and H, and an FB-111. In addition to the two loadings, each team will also be evaluated on the condition of its equipment and by a written test. The max possible score for each loading team will be 1500 points.

Security police teams will be scored to a max of 1500 points. Realistic security situations involving the protection of alert bomber aircraft and weapons will be staged for each team in addition to a written test and M-16 rifle firing.

The HQ SAC Director of Munitions, Col Alton W. Powell, will be the 1978 GIANT SWORD munitions loading competition commander. The competition deputy commander for munitions matters will be Lt Col Patrick A. Palmier and the GIANT SWORD deputy commander for security police matters will be Lt Col Fredric L. Miller

HISTORY — The first SAC Munitions Loading Competition was held at MacDill AFB in March 1958 with the 29th Aviation Depot Squadron from Homestead AFB taking top honors. A second competition, hosted by March AFB was held in October 1958. From there, the competition moved to Bergstrom AFB for the next two years.

With the advent of the war in Southeast Asia, the competition was suspended for 13 years. During those 13 years, SAC munitions personnel proved their professionalism and capabilities by supporting the Southeast Asia effort, while at the same time maintaining SAC's primary mission of strategic deterrence.

The Munitions Loading Competition was reborn

CMSgt. Wilbur R. Barrentine Memorial Munitions Loading Trophy

The trophy memorializes the late Chief Master Sergeant Wilbur R. Barrentine who is remembered by his supervisors and fellow workers as a "people oriented" manager. Chief Barrentine was associated with Strategic Air Command munitions loading from the mid-1950s until his death in September 1970 while serving on active duty. He made significant contributions to SAC's commandwide munitions safety record during his career. His experience and managerial ability helped munitions loaders throughout SAC convert from a stateside nuclear alert mission to an active conventional weapons loading role during the conflict in Southeast Asia.

GIANT SWORD '78

in 1974 with the renewal of the Bombing and Navigation Competition at Barksdale AFB and was held concurrently at Blytheville AFB. Aircraft crew chiefs were included as integral members of the munitions load crews. The 93d MMS from Castle AFB won the "Best in SAC" trophy at the 1974 meet.

The 1975 competition at Ellsworth AFB was expanded to include an aircraft security police element. With the addition of security procedures to the competition, the day-to-day munitions loading team effort is accurately demonstrated. SAC's GIANT SWORD is teamwork, not weapons. We are meeting again to have the edge of that sword honed and determine who is the "Best in SAC."

In the 1975 competition, Castle's 93d Bomb Wing retained its title as the best munitions unit in the Strategic Air Command. In 1976, Carswell's 7th Bomb Wing won the prestigious Barrentine Trophy. Last year, in the closest race ever, Castle's 93d Bomb Wing edged out Grand Forks' 319 Bomb Wing in the final moments of competition. Castle's feat enabled them to recapture the "Best in SAC" trophy for an unprecedented third time.

AWARDS — The Barrentine Memorial Trophy. This trophy is awarded to the wing whose competition team compiled the highest overall score. The winning wing will retain the trophy for one year. A plaque will be awarded for permanent retention by the wing. Each member of the winning team will receive a chalice, certificate and winner's patch for permanent retention.

Best Munitions Load Crew in SAC. This award goes to the winning munitions maintenance squadron to serve as recognition of the outstanding achievements of its load crew. The winning wing will also retain this trophy for one year. A plaque will be awarded for permanent retention by the unit. Each member of the MMS load crew and the OMS crew chief will be awarded a chalice, certificate and winner's patch for permanent retention.

Giant Sword Best Security Police Unit. The security police trophy is awarded to the winning security police squadron to serve as a testimonial to the outstanding achievements of its security police team. The trophy will be retained for one year. A plaque will be awarded for permanent retention by the unit. Each member of the security police team will also receive a chalice, certificate and a winner's patch for permanent retention.

A plaque will be awarded to the load crew that scores the highest total points for two loads, to the security police element having the highest score in the practical exercise and to the best aircraft crew chief. Plaques are to be retained permanently by units. Suitable awards will be awarded to each member of the winning team in each category.

Giant Sword '78 will be a keenly competitive event. Each year there has been an increase in the proficiency and knowledge displayed at the loading competition. This year will be no different. Good luck to all participants — the competition is going to be tough!

1977 GIANT SWORD WINNERS

Best Munitions Competition Team (Barrentine Trophy) — 93BW, Castle AFB, CA.

Best Security Police Unit — 379SPS, Wurtsmith AFB, MI.

Best Aircraft Crew Chief — 5 OMS: SrA Keith D. Rappleyea, Minot AFB, ND.

Best Munitions Team — 7MMS, Carswell AFB, TX.

Best Security Police Practical Exercise — 379SPS, Wurtsmith AFB, MI.

Best Academic Excellence — 93SPS, Castle AFB, CA.

Best Security Police Marksmanship — 93SPS, Castle AFB, CA.

Best Loads — 319MMS, Grand Forks AFB, ND.

Best B-52 Load — 319MMS, Grand Forks AFB, ND.

Best FB-111 Load — 380MMS, Plattsburgh AFB, NY.

Best SRAM Load — 319MMS, Grand Forks AFB, ND.

Blank pages

The one thing that bothers me more than anything else is a story that is incomplete. A two part serial in a magazine infuriates me — especially when I was unaware of the fact until I read "to be continued." Worse still, missing pages from a book will cause untold agony. That's why I take great interest in having all my flight publications current and up to date. On one flight however, I found to my chagrin that there were blank pages in my checklist. Not the pages that are intentionally blank, but the ones that are an essential part of the book.

I was in an upgrade program in a new aircraft as aircraft commander. I had well over 1300 hours previously in a C-47 with about 300 hours of instructor time. In short, I told myself that I was no longer a rookie and could act like I knew something about flying. Unfortunately, I think I succeeded. The copilot who was assigned to our student crew was fresh from pilot training. I impressed him immensely with my expertise: the airplane would always fly a level turn for me, airspeed never deviated more than two knots, altitude control was impeccable. Our instructor did not say much after the first few rides except to say that he was in for an easy time. It was easy — until I discovered those blank pages.

On our eighth ride, we flew a night mission of about six hours duration. After a refueling and navigation leg we returned to the base for traffic pattern practice. After the tenth pattern, the instructor simulated loss of an outboard engine. With a calm confidence I called for action on the required checklist items and maneuvered for a landing. Another simulated emergency: truck on the runway!

"Go around!" I cried, and deftly managed power and rudder to keep myself down the runway centerline. "Flaps 30°! Speed brakes down! Gear up!" Beautiful! I hadn't forgotten a thing.

"Bring it around," said the IP. "Let's put this beast on the ground for the night."

One more pattern. Good thing though, because I was getting tired.

"Traffic pattern checklist," I called as we rolled out on downwind. I had all four engines now and all was normal.

"Crew briefing," called the IP.

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r&d corner

Major Larry C. Hyden
Hq SAC/XPHN, Offutt AFB

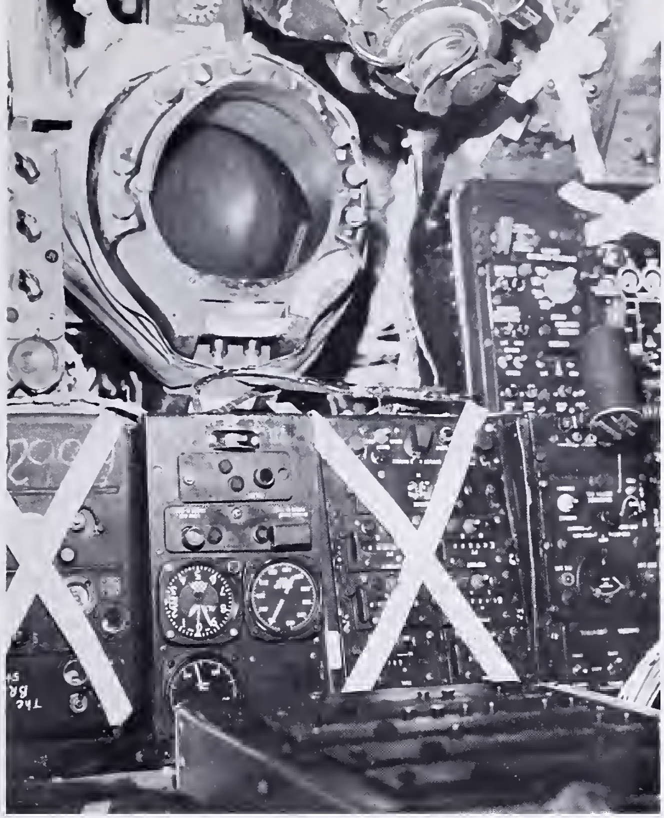
LOOK WHAT'S COMING — I'm not going to begin this story by trying to fabricate a catchy public relations scenario about a new Digital Bombing System for the B-52D. What I want to do is simply tell you about the new system that is flying aboard the B-52D and producing outstanding results. I'll let you draw your own conclusions and then you make up the scenarios. Believe me, it won't be difficult to put the B-52D in a lot of new roles and greatly enhance the old ones.

By way of a short background, the DCS/Plans (XP) Deputate at HQ SAC began writing a Required Operational Capability (ROC) in October of 1976 to replace the aging B-52D Bomb Nav System (BNS). While preparing that ROC, it was learned that AFLC was projecting logistics problems with the current system to the point that they also decided to replace the old system. Upon examining the AFLC proposal, it was determined that it would meet SAC's requirements; thus, SAC and AFLC joined together in pursuing the AFLC modification. Since October 1977, AFLC and SAC have been testing the IBM Digital Bomb Nav System (DBNS), fully integrated with the SPN/GEANS inertial, aboard a B-52D at Carswell AFB.

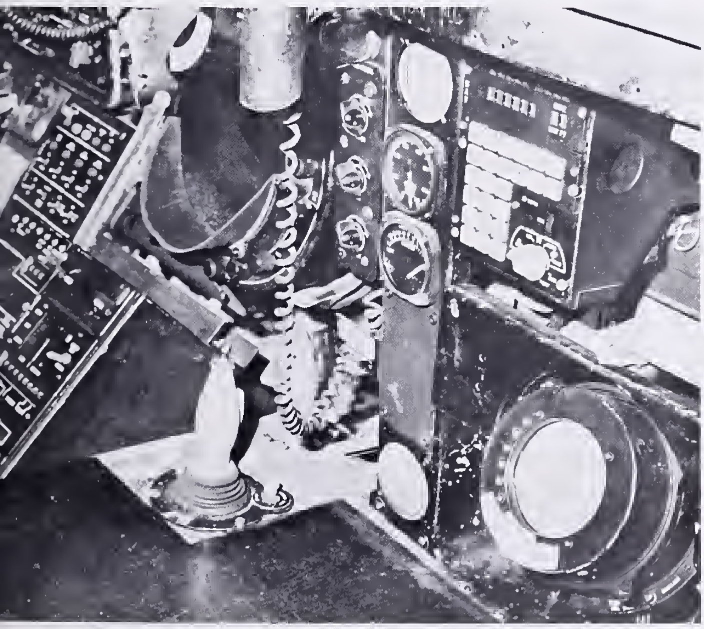
The DBNS is designed around the Automated Offset Unit presently installed in the B-52G/H. It provides the capability to store up to two hundred destinations, targets, and offsets. It has a mean-time-between-failure (MTBF) in excess of 500 hours. Integrated with the DBNS is a high accuracy inertial system developed by the Air Force Avionics Laboratory at WPAFB. The inertial system is the SPN/GEANS which stands for Standard Precision Navigator (SPN) Gimballed Electrostatically suspended gyro Aircraft Navigation System (GEANS). I spell that out because part of the name, Electrostatically Suspended Gyro (ESG), tells you why it is a little different. The system does not use conventional gyros; rather, it uses 1¼″ beryllium balls electrostatically suspended which exhibits virtually no resistance. For example, if power were removed after the SPN/GEANS is aligned, except for suspension voltage, you could expect the ESGs to continue spinning for over a year. The SPN/GEANS also has an attractive MTBF of over 650 hours.

As mentioned previously, these systems are fully integrated and flying aboard a B-52D. The SPN/GEANS is the main sensor feeding information into the DBNS. The DBNS is the large processor or heart of the system that takes all the inertial, doppler, and fixing information (Astrotracker is removed) and feeds it into the navigation model. It automatically steers the aircraft (since it is integrated into the autopilot system), positions the cross-hairs from checkpoint to checkpoint or offset to offset, and provides accurate ballistics updated thirty-two times every second.

One of the most unique features of the system, except for accuracy, is its ease of operation. There are basically only four control and display panels needed to operate the DBNS. I have included before and after pictures of the panels as installed in the aircraft at Carswell; however, keep in mind that this is not the production version. Figure 1 shows the old controls and displays with white "Xs" indicating panels which will be removed. Figure 2 is a photo of the controls and displays installed for flight test only. The production version has redesigned panels which insure that all controls and displays are well within reach, easily viewed, and functionally grouped for the radar navigator. The navigator maintains access to the keyboard for data entry and display and to the SPN/GEANS counters for navigation. Additionally, the 10 inch radar scope will be moved to a position 16 inches in front of the radar navigator and the controls and displays will be mounted flush with the scope. Would you also believe a work table extending across



(Figure 1) "X" denotes panels or equipment to be deleted or replaced.



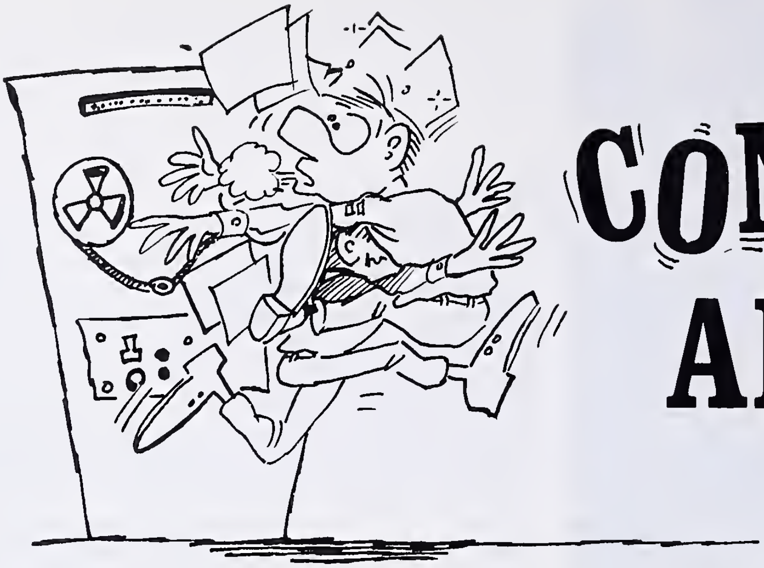
(Figure 2) The new equipment (demo only) is pictured above the Nav scope and to the lower left of the radar scope.

the entire area!

With regard to testing, I can't tell you actual bombing results due to classification; however, I can say that the system has performed missions which simulate all current and projected taskings for the B-52D. Bombing missions, long overwater missions and high latitude missions are a few of the testing profiles. The Radar Bomb Scoring results have been outstanding and certainly rival the FB-111A accuracy. Additionally, live drops from both low and high altitude at Hill AFB test range further confirm the accuracy of the system. A live drop of mines during a recent Navy exercise drew smiles from the Air Force and "well dones" from the Navy. Although I can't discuss actual bombing results I can talk about the navigation in real terms.

The SPN/GEANS inertial is capable of both inflight and ground alignment. For inflight alignment, it has been navigating in the .18 NM/hr or 1095 ft/hr regime. For ground alignment, the system has averaged .074 NM/hr or 450 ft/hr. During November 1977, Carswell crews flew two SPN/GEANS equipped aircraft to the North Pole and back (18½ hrs). The DBNS aircraft was inflight aligned during the first hour and flew the next 17½ hrs without an update. The system navigated at .115 NM/hr or 699 ft/hr. The second aircraft, with a SPN/GEANS installed on a pallet, was ground aligned. It flew the entire 18½ hour mission, without updating, and navigated at .015 NM/hr or 91 ft/hr. Total error on landing at Carswell was 1,684 feet. Current modification schedule for the B-52D shows the first of the Pacer Plan aircraft entering the modification line in July 1980 and the last one out in May 1982. Additionally, the T-10 trainers will undergo a complete modification and will be available within sufficient lead time to conduct crew training. Total program cost is approximately $110M.

One additional note for the B-52G/H crewmembers. Although this system is different from the B-52G/H proposed avionics modification (due to SRAM, cruise missile, and EVS interface considerations), the SPN/GEANS is also planned for those aircraft. Dr. John Martin, Assistant Secretary of the Air Force for Research, Development and Logistics has determined that the SPN/GEANS will most likely be installed aboard all B-52s. In summary, the DBNS and SPN/GEANS test results have met or exceeded our expectations. Obtaining this modification will solve the reliability, maintainability, and supportability problems of the current system. Additionally, the accuracy of the system will certainly increase the viability of the B-52D in all its current and projected roles.



CONFLICT ALERT

As the number of aircraft services by ATC increased, the FAA realized that a need existed to provide the controller with an additional method for detecting potential conflicts between aircraft. To provide this, an automatic conflict detection and alert function was incorporated into the en route ATC systems computer. This new function is called Conflict Alert. Conflict Alert is a computer software program that detects potential conflicts defined by two parameters; horizontal separation (5 miles) and altitude separation (1,000 feet, 2,000 feet above flight level 290 and 500 feet for VFR on top).

Conflict prediction is accomplished by projecting a current aircraft track position into the future (2 minutes). This future position is the result of a three dimensional tracker which uses information from long range radar and Mode C altitude reports from aircraft transponders or pilot reported altitudes entered into the computer by controllers. Whenever the airspace, associated with an aircraft track, touches the airspace associated with another aircraft track, a flashing alert is generated on the controller's display which identifies the situation and aircraft involved.

To be eligible for sensing by the Conflict Alert program, an aircraft MUST BE TRACKED by an ARTCC. When an aircraft is tracked in the NAS computer, the identified radar target is associated with information about that flight and a data tag is displayed automatically with the target. The tracking function keeps the data tag on the target as the flight progresses along its route. This includes VFR flights which are being tracked and provided ATC services by an ARTCC.

Pilot responsibility is not altered by the Conflict Alert program nor is there any special radio terminology required. If a flight is detected in a potential conflict, the pilot will receive a safety advisory or, in the case of an IFR flight, a clearance from ATC. Because verbal altitude reports from non-Mode C aircraft are required, a timely response to controller request for altitude reports is essential so that new data can be entered to insure accurate prediction of aircraft position.

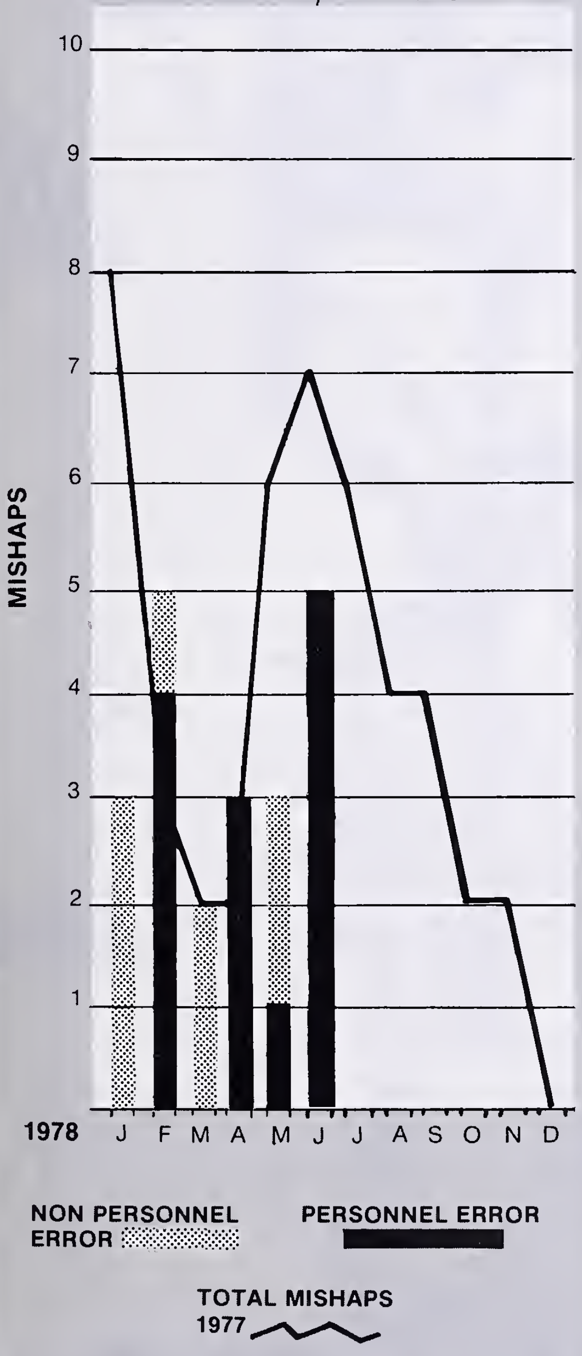
The computer at the 20 centers where Conflict Alert is in operation is a high speed reliable system; however, its resources are not limitless. Because of this, programs like Conflict Alert must share time with other ATC processes. Therefore, the computer cannot inspect every track continuously. However, once a possible conflict is detected, continuous processing is performed until the situation is resolved. Long range radar has a relatively slow scan rate and because radar tracking and predicted positions are based on history, there is an inherent lag. Consequently, if aircraft make rapid or abrupt maneuvers, a conflict situation can go undetected.

There are several areas in which the use of Conflict Alert is not operationally feasible. This includes certain control sectors that are adjacent to terminal radar approach control facilities, where separation criteria of less than 5 miles is being applied, certain control sectors which routinely service military operations which involve extensive aircraft maneuvers, and very busy sectors where data entry can fall behind. Because these conditions can create unwanted alerts, controllers may suppress the Conflict Alert function for individual aircraft or for his sector.

Conflict Alert cannot replace good operating practices and is designed to provide air traffic controllers with additional information to assist them in providing air traffic services. There is no operational program or procedure in current use that will replace the "see and avoid" practice from the cockpit. The use of Conflict Alert in no way relieves the pilot of his responsibility for the safe operation of his aircraft as prescribed in the Federal Aviation Regulations. Adapted from a recent FAA Advisory Circular.

Missile Mishap Report

DOD CLASS A, B and C



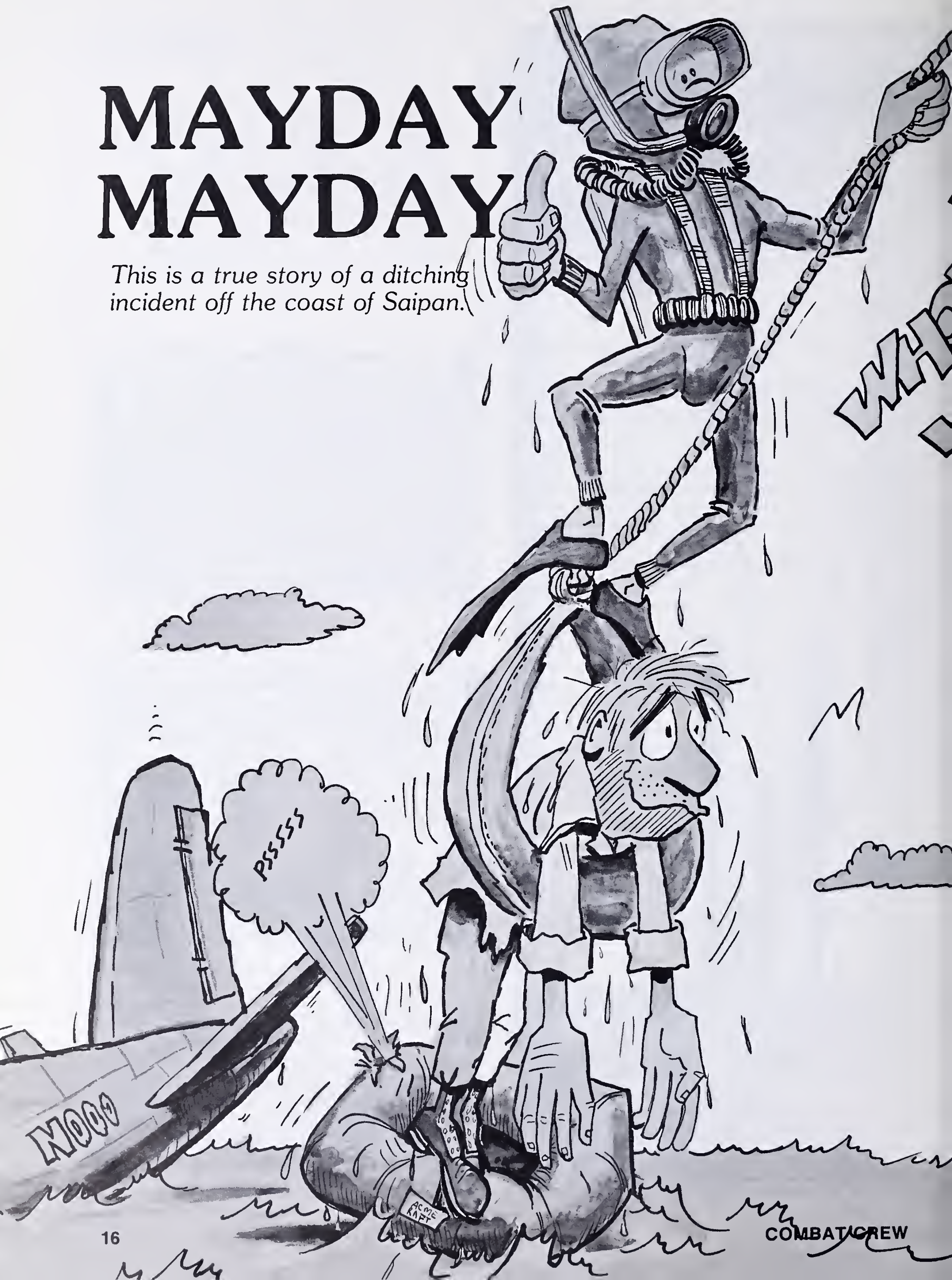
At a Minuteman LF, during a gas generator electrical checkout, the team discovered a cross-threaded cable coupler. In order to repair this coupler, the team was required to replace the coupler and the gas generator retainer ring. In the process of replacing the retainer ring, the team failed to remove pressure from the actuator assembly as directed by the TO. When the retainer ring was removed, the gas generator cartridge was forced out by the existing air pressure. The result of this mishap was a damaged cartridge and injury to one of the team members. Another individual who had to learn to follow tech data the hard way.

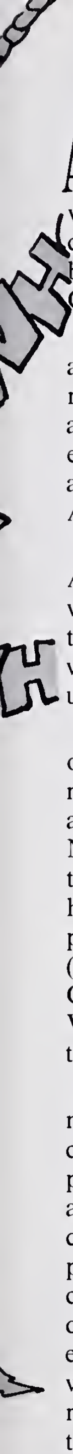
During a Minuteman missile removal, the missile maintenance team failed to disengage the adapter ring lockdown pins prior to raising the missile. When the missile was raised four to five feet from the suspension system the hoist on the transporter-erector hesitated and strained. Initially the team thought that the missile had just been temporarily caught on the suspension system; however, further investigation revealed that the missile was still connected to the suspension system. The technicians had misinterpreted the applicable tech data steps and rotated the adapter ring lockdown handles 90 degrees instead of the required 45 degrees. Assuming can be dangerous!

During a BULLET BLITZ/BUSY LUGGAGE exercise, a SRAM missile exploded. All initial flight indications were normal until 3.2 seconds into the second pulse burn, at which time the internal pressure rapidly increased to a point which exceeded the motor case structural limit. The pressure was due to an increase in the burn area of the second pulse propellant. This material failure mishap cost $541,000.

MAYDAY MAYDAY

This is a true story of a ditching incident off the coast of Saipan.





After completing normal morning activity, an intrepid pilot, captain type, looked out on another beautiful morning on sunny Guam. A clear day with little wind, it was perfect for his first cross country solo in the Aero Club Cessna 150. After breakfast, he was off to the Naval Air Station Aero Club to meet his instructor.

Meanwhile, an earnest compadre, major type, arrived at 0705 to open the club office. The major, a radar navigator assigned to the Bomb Nav Branch at Andersen, is an Aero Club instructor on weekends. This Saturday he was helping the captain plan and coordinate a solo cross country from Andersen AFB to Rota, Saipan.

Everything was quite normal through preflight. All instruments looked good and all survival items were in place. At 0805, our captain got clearance for take-off. Minutes later he was level at 5500′ over the water. There were very few clouds and visibility was unlimited; it just couldn't be better — or could it?

Halfway between Guam and Saipan, over open ocean, with no emergency fields nearby, the engine rpm suddenly decreased to idle. The captain tried to adjust the throttle, but the rpm would not increase. Next, his emergency training seemed to take control. He performed the steps his instructor taught him for just such an emergency. First, fly the airplane (sound familiar?). Next, trim and airspeed. (This is beginning to sound like a briefing from the Certified Flight Instructor Course for B-52 IPs.) With the airplane under control, however, our captain made his Mayday transmission.

Guam approach responded to the call. Approach monitored the aircraft position while the captain continued his futile attempts to increase engine power. After several runs through the checklist and a conversation with an Aero Club IP, our intrepid captain told approach that he couldn't make Saipan. He was going to ditch. When he realized he couldn't glide to a land base, he began to review ditching procedures. He checked his personal equipment and everything was in place. The life vest was securely fastened and the raft was within arm's reach. Restraining devices were tight and the captain was ready for the final phase.

He turned the aircraft into the wind and waited. Initial water impact was not severe; he had taken worse falls while water skiing. As the tail hit, the nose dove into the water at a 60° angle. The next sensation was water in the cockpit. He removed restraining devices and opened the aircraft door. As he exited, he shoved the life raft out the door. Once in the water, the waves pushed him against the airplane. This caused some problems. He was forced under the water as the wing came down near his head. Finally, he got clear of the airplane and found the life raft, but another problem developed.

The sea anchor on the raft was entangled in the airplane. As the airplane sank, so did the life raft. Frantically, he pulled and gnawed at the ropes (sure could have used a knife about then). Finally, the ropes came loose and the raft was free. He crawled in the raft and waited for rescue.

At 0920 the rescue chopper arrived and out jumped a frogman with a buck knife in his teeth (you guys are here to rescue me, aren't you?). Our inspired captain told the frogman he could swim, and he wasn't hurt. Then came the shocker. The frogman punctured the life vest and the raft. This action prevented either item from being sucked into the helicopter's rotors, however, the action didn't do a thing for our captain's confidence. As he floundered in the water waiting for the chopper and its horse collar, the captain drank a gallon or two of ocean. Finally, the collar was secured around the victim and he was pulled to the safety of the helicopter.

The rest of the story is a happy ending. Wife, instructor, and FAA official were all relieved to see our captain when he got back to the Naval Air Station, but the story isn't quite over. There are certainly some lessons to remember (none of them are new).

First, our intrepid captain used all the flying ability he had to stop, think, and analyze the situation. Remember the poster with a Cessna 150 and MAC 141 which reads: "Both Require Proficiency and Judgment"? Well, it's certainly true. Ditching a fixed gear airplane is no good deal, but training and proficiency really paid off.

Second, don't assume the aircraft is useless when initial impact occurs. You have survival equipment, but you must know where it is and how to use it.

Finally, the rescue is not complete just because SAR arrives. All your land and sea survival training is worthless if you don't do your part to help the rescuers.

Needless to say, our captain who had less than 100 flying hours at the time of the mishap learned much from this experience.

BIG INSTRUMENT

QUESTIONS AND ANSWERS

Captain Lewis M. Hatch
1st Combat Evaluation Group
Barksdale AFB

The now defunct Instrument Pilot Instructor School (IPIS) spent a great deal of time analyzing and categorizing technical questions concerning instrument procedures. As a result of years of study, they were able to determine that all technical questions would fit in one of two general categories, and there was one universal answer for each of these categories. Realizing that from this day forward I will be plagued with pitot-static icing, gyros that won't gyrate, dopplers that won't dopple, and terminal spatial disorientation (due to a receding hairline in my inner ear); I will now violate the sacred oath of secrecy and reveal the questions and (GASP!) the correct answers.

Question	Answer
"What should I do if . . ."	"It depends."
"Why (do/don't) we . . ."	"Cause it (is/is not) in the book."

Let's see how these Basically Universal but Logically Limited answers (call BULL answers) have stood the test of time by applying them to some technical questions we have heard around the command.

SIDESTEP MANEUVER

Q. What should I do if I am told to "sidestep?"

a. Do the new dance step I learned at John Travolta's School of Disco Dance.
b. Perform an evasive maneuver perfected by Gale Sayers for broken field running.
c. Apply public speaking and debate techniques used by some politicians to avoid answering a question.
d. It depends.

A. It depends — on where you are and what you are doing. (As you can see, if you didn't know that the correct answer to any "What should I do if . . ." question is "It depends," answer "b" might mislead you since it contained the word "maneuver.")

The sidestep maneuver as it applies to instrument flying is discussed in the "Airman's Information Manual (AIM)," Part I, and FAAH 7110.65A (Air Traffic Controller's Handbook). Unfortunately, the information in these volumes is not entirely accurate and has caused some confusion among pilots.

The sidestep maneuver is defined as, "A visual maneuver accomplished by a pilot at the completion of an instrument approach to permit a straight-in landing on a parallel runway not more than 1200 feet to either side of the runway to which the instrument approach was conducted." The AIM further states, "Pilot's are expected to commence the side-

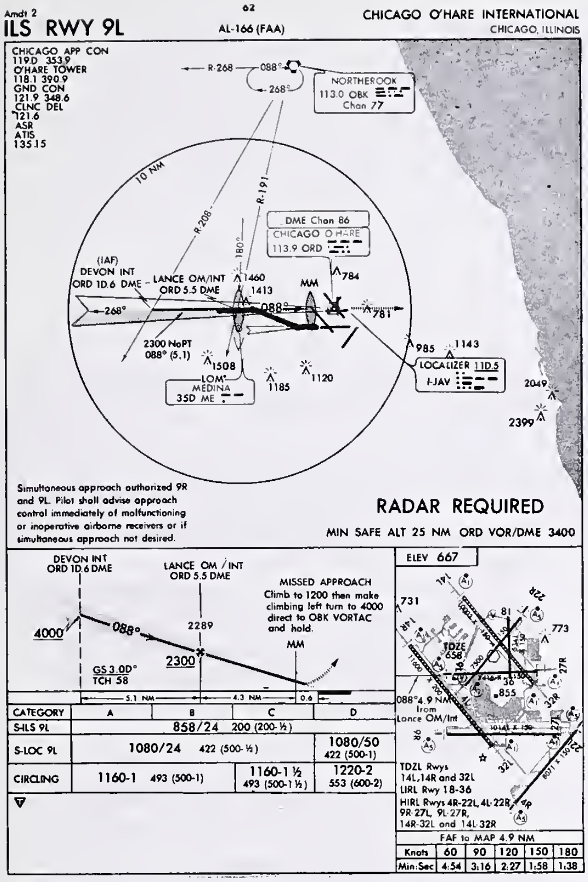

Amdt 2
ILS RWY 9L
AL-166 (FAA)
CHICAGO O'HARE INTERNATIONAL
CHICAGO, ILLINOIS
CHICAGO APP CON 119.0 353.9
O'HARE TOWER 118.1 390.9
GND CON 121.9 348.6
CLNC DEL 121.6
ASR
ATIS 135.15
NORTHBROOK 113.0 OBK Chan 77
DME Chan 86
CHICAGO O'HARE 113.9 ORD
(IAF) DEVON INT ORD 10.6 DME
LANCE OM/INT ORD 5.5 DME
LOCALIZER 110.5 I-JAV
LOM MEDINA 350 ME
2300 NoPT 088° (5.1)
10 NM
Simultaneous approach authorized 9R and 9L. Pilot shall advise approach control immediately of malfunctioning or inoperative airborne receivers or if simultaneous approach not desired.
RADAR REQUIRED
MIN SAFE ALT 25 NM ORD VOR/DME 3400
MISSED APPROACH Climb to 1200 then make climbing left turn to 4000 direct to OBK VORTAC and hold.
GS 3.00° TCH 58
ELEV 667
TDZE 658
CATEGORY A B C D
S-ILS 9L 858/24 200 (200-½)
S-LOC 9L 1080/24 422 (500-½) 1080/50 422 (500-1)
CIRCLING 1160-1 493 (500-1) 1160-1½ 493 (500-1½) 1220-2 553 (600-2)
TDZL Rwys 14L, 14R and 32L
LIRL Rwy 18-36
HIRL Rwys 4R-22L, 4L-22R, 9R-27L, 9L-27R, 14R-32L and 14L-32R
FAF to MAP 4.9 NM
Knots 60 90 120 150 180
Min:Sec 4:54 3:16 2:27 1:58 1:38

FIG. 1

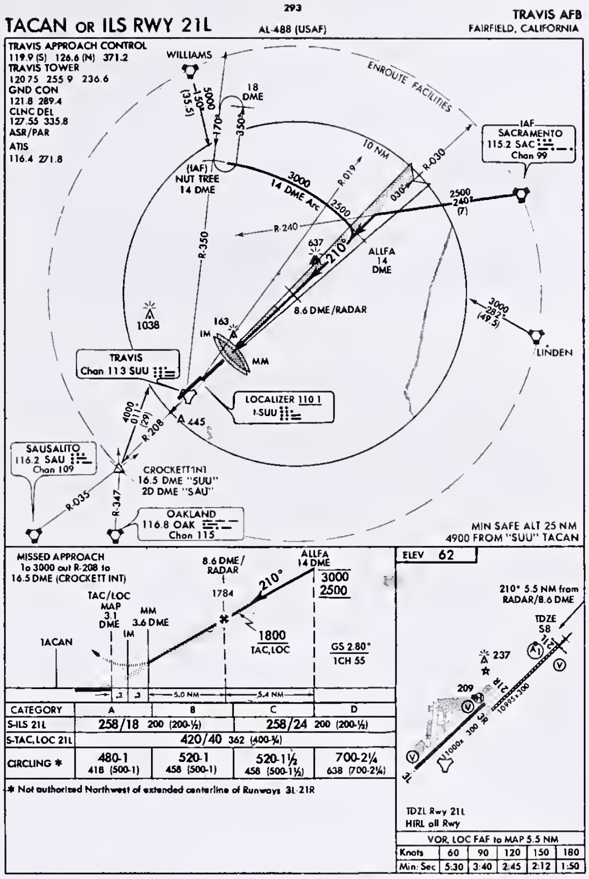

TACAN OR ILS RWY 21L
AL-488 (USAF)
TRAVIS AFB
FAIRFIELD, CALIFORNIA
TRAVIS APPROACH CONTROL 119.9 (S) 126.6 (N) 371.2
TRAVIS TOWER 120.75 255.9 236.6
GND CON 121.8 289.4
CLNC DEL 127.55 335.8
ASR/PAR
ATIS 116.4 271.8
WILLIAMS
ENROUTE FACILITIES
IAF SACRAMENTO 115.2 SAC Chan 99
(IAF) NUT TREE 14 DME
3000 14 DME Arc
ALLFA 14 DME
8.6 DME/RADAR
TRAVIS Chan 113 SUU
LOCALIZER 110.1 I-SUU
SAUSALITO 116.2 SAU Chan 109
CROCKETT INT 16.5 DME "SUU" 20 DME "SAU"
OAKLAND 116.8 OAK Chan 115
LINDEN
MIN SAFE ALT 25 NM 4900 FROM "SUU" TACAN
MISSED APPROACH To 3000 out R-208 to 16.5 DME (CROCKETT INT)
GS 2.80° TCH 55
ELEV 62
TDZE 58
CATEGORY A B C D
S-ILS 21L 258/18 200 (200-½) 258/24 200 (200-½)
S-TAC, LOC 21L 420/40 362 (400-¾)
CIRCLING * 480-1 418 (500-1) 520-1 458 (500-1) 520-1½ 458 (500-1½) 700-2¼ 638 (700-2¼)
* Not authorized Northwest of extended centerline of Runways 3L-21R
TDZL Rwy 21L
HIRL all Rwy
VOR, LOC FAF to MAP 5.5 NM
Knots 60 90 120 150 180
Min:Sec 5:30 3:40 2:45 2:12 1:50

FIG. 2

step maneuver as soon as possible after the runway or runway environment is in sight." So the maneuver itself is relatively simple. It involves flying a straight-in instrument final approach to one runway. As soon as good visual reference with the runway environment is available, simply sidestep over to a visual final approach on the cleared parallel runway. The clearance should sound like this: "Cleared for ILS runway 09 left approach, sidestep to runway 09 right." (Figure 1) The confusion arises when you attempt to determine what the approach minimums are.

According to AIM, Part I, "Landing minima to the adjacent runway will be higher than the minima to the primary runway, but will normally be lower than the published circling minima." This would make sense, but criteria were never established to publish sidestep minima. Consequently, if you are instructed to sidestep, use circling minima. Remember, however, that you have not been cleared to circle even if you are using circling minima. The only maneuver the controller expects to see is the sidestep to the adjacent final approach. If you desire to circle, **you must get clearance.**

One last consideration when flying a sidestep maneuver is the amount of maneuverability required and the length of final approach. The pilot must use good judgment in selecting airspeeds and configurations for the approach. It may be desirable in certain conditions (Travis AFB, Figure 2) to delay establishing landing configuration if you must fly for a long distance before intercepting the visual final approach.

SID RESTRICTIONS AND ALTITUDE AMENDMENTS

Q. I am flying a SID with several published altitude restrictions. **What should I do if** I receive an amended altitude clearance?

a. Ignore it, since an amendment requires ratification by two-thirds of Congress.
b. Check the latest issue of the *Air Force Times* to see if the amendment was included in last week's legislation.
c. Accept it, because you don't know anything about politics.
d. It depends.

A. It depends — on where you are.

SID restrictions and altitude amendments have become major topics of discussion recently. A change to pilot/controller responsibilities in this area has been published in FLIP GP, AIM, Part I, and FAAH 7110.65A. Most pilots are familiar with

BIG INSTRUMENT

the new wording in FLIP GP, Paragraph 5-12a (stating that any time a pilot is vectored or cleared off of a SID or its transition, he may consider it cancelled, and ATC must restate any routing and all applicable altitude restrictions if they wish to reinstate any portion of the SID). They may not have noted the change to paragraph 5-14 dealing with adherence to air traffic clearances.

FLIP GP, paragraph 5-14b, states, "When the route **or altitude** in a previously issued clearance is amended, the controller will restate applicable altitude restrictions. If previously issued altitude restrictions are omitted from an amended clearance, those altitude restrictions are cancelled." This statement applies to SID published altitude restrictions. FAAH 7110.65A further instructs controllers that restating an assigned altitude to an aircraft already established on the assigned routing is an altitude amendment and requires them to restate any applicable restrictions. Let's see how all this works out for the pilot.

Prior to actual departure, the pilot is issued a clearance including a SID and a "maintain" altitude. This may be amended at any time **prior** to actual departure and all published restrictions still apply. Once **airborne** on the routing, however, any new "maintain" altitude (or restatement of the assigned altitude) will delete all restrictions unless they also are restated. This also applies to an aircraft in the pattern issued a SID as part of the missed approach instructions. Until actual missed approach, the altitude restrictions on the SID will apply. If the "maintain" altitude is changed or restated after the aircraft is established on the departure, any applicable restrictions must be restated.

One point of confusion has arisen in this area. The Pilot/Controller Glossary contained both in the AIM and FAAH 7110.65A has not been changed to reflect the new procedure. The definition of "maintain" still states that previously issued restrictions apply. Until the Glossary is aligned with existing procedures, some confusion may be encountered. But remember, FLIP GP 5-14b states, "Pilots should always request route/altitude verification from ATC if any portion of a clearance is not completely understood." A simple statement when acknowledging a new altitude to insure both pilot and controller are on the same wave length is the easiest way (i.e., "Wilco, Vega 15 cleared unrestricted to 5000.").

MONITORING THE STATION IDENTIFIER

Q. Why do we have to monitor a navigation station identifier?

a. Because if you don't, they'll send you to Adak, Alaska, to be the VOR voice identifier ("Adak V-O-R . . . Adak V-O-R . . .").
b. Because the VOR Disc Jockey's Union has it in our contract.
c. It depends.
d. 'Cause it's in the book.

A. 'Cause it's in the book (AFM 51-37). (Since this is a "Why . . ." question and **not** a "What should I do . . ." question, answer "c" is obviously wrong.)

Most pilots are familiar with the requirement to continuously monitor the station identifier of any electronic navigation aid while it is being used for navigation (this includes Nav Leg fixing). AFM 51-37 says that you must consider a station's information unreliable if the identifier is not heard. This requirement is established because of the manner in which the station is constructed and operated. The identifier feature is part of an automatic sensing unit that detects any error in the equipment. When an error is detected, the automatic monitoring unit will switch to another transmitter, if available. If an error is still present, it should shut the station down entirely. Loss of the identifier while you still have course guidance (VOR or TACAN) indicates a probable failure of the automatic monitoring function. In this case you have no guarantee that the information you are receiving is accurate. In the worse possible case, it may indicate that an error was present, the identifier shut down; but the station transmitter was not shut down.

The most common situation that will lead to reception of course information without an identifier being present is station maintenance. If a station is being tuned or adjusted, the identifier will not be transmitted. It is removed because the station **may not be reliable for navigation** during its maintenance. At any time you fail to receive an identifier: (1) consider the station's information unreliable, (2) inform your air traffic controlling agency or a flight service station, and (3) find yourself another suitable station.

RADAR VECTOR: WHY 2½°?

Q. On radar vectors to a published instrument approach . . . **why do we** wait until we are within 2½° of course before descending from our last assigned altitude?

a. It depends on whether it's 2½° centigrade or 2½° Fahrenheit.
b. Because 2½° is one-half of 5°.
c. Because of the quadrotronic framistan held in place by the histonic hexnut located in the nost of most aircraft.
d. 'Cause it's in the book.

A. 'Cause it's in the book (AFM 51-37).

We've talked about the requirement to be within 2½° of course prior to descent out of your last assigned altitude before, so I don't want to dwell on it. But some pilots have wanted to know what's magic about 2½°. Actually there's nothing magic about it. Simply stated, the figure 2½° is based on the maximum allowable on-board equipment error of 4° (you checked for that at the posted check point prior to takeoff — remember?) combined with the most restrictive approach design possible under TERPs (AFM 55-9). This figure is conservative and will insure that if you have maximum equipment error, in the worst direction, combined with the most restrictive approach design possible, **you will have obstruction clearance.**

One thing to remember when you are looking for 2½° in the cockpit: when you are flying with TACAN or VOR selected, each dot is **5**°. You should not descend until you are within ½ dot on your CDI. If you are flying to an ILS with ILS selected, you may descend when the CDI comes off of the side of the case. This will give you protection even if you are flying the new solid state ILS (which may give you more or less than 2½° at "case break"). For a discussion of solid state ILS, see *Aerospace Safety,* "IFC Approach" (January, 1978).

If you have questions or comments concerning this article, or any questions in general concerning instrument procedures and techniques, please drop a line to 1 CEVG/STI, Barksdale AFB LA 71110 or call Autovon 781-3648.

THE EDGE...

Continued from page 3

about discipline, responsibility, and job performance, they, also, will be. In many cases the professional attitude you see in each individual will be influenced, to a great degree, on his perception and interpretation of your actions.

Respect of our superiors, peers, or subordinates cannot be ordered, decreed, or demanded; it has to be earned. That respect is largely dependent upon your demonstrated professionalism. The individual who exerts extra effort to continually improve his job performance and expand his background knowledge is the one that has made a mental commitment for excellence. He accentuates the positive about his part of the overall mission. He has confidence, enthusiasm and integrity of character. He sets his personal standards of professionalism high and lives up to them. He is reliable, consistent, and predictable. I think we all try to emulate such standards. The key is mustering up the "mental toughness" necessary to transition from including these standards in our annual "New Year's resolution," to weaving these objectives into a daily activity pattern as "a way of life."

Professionalism depends upon a good self-image. Knowing who you are and what you stand for is important. Others will judge you and frequently mold their professionalism to reflect yours.

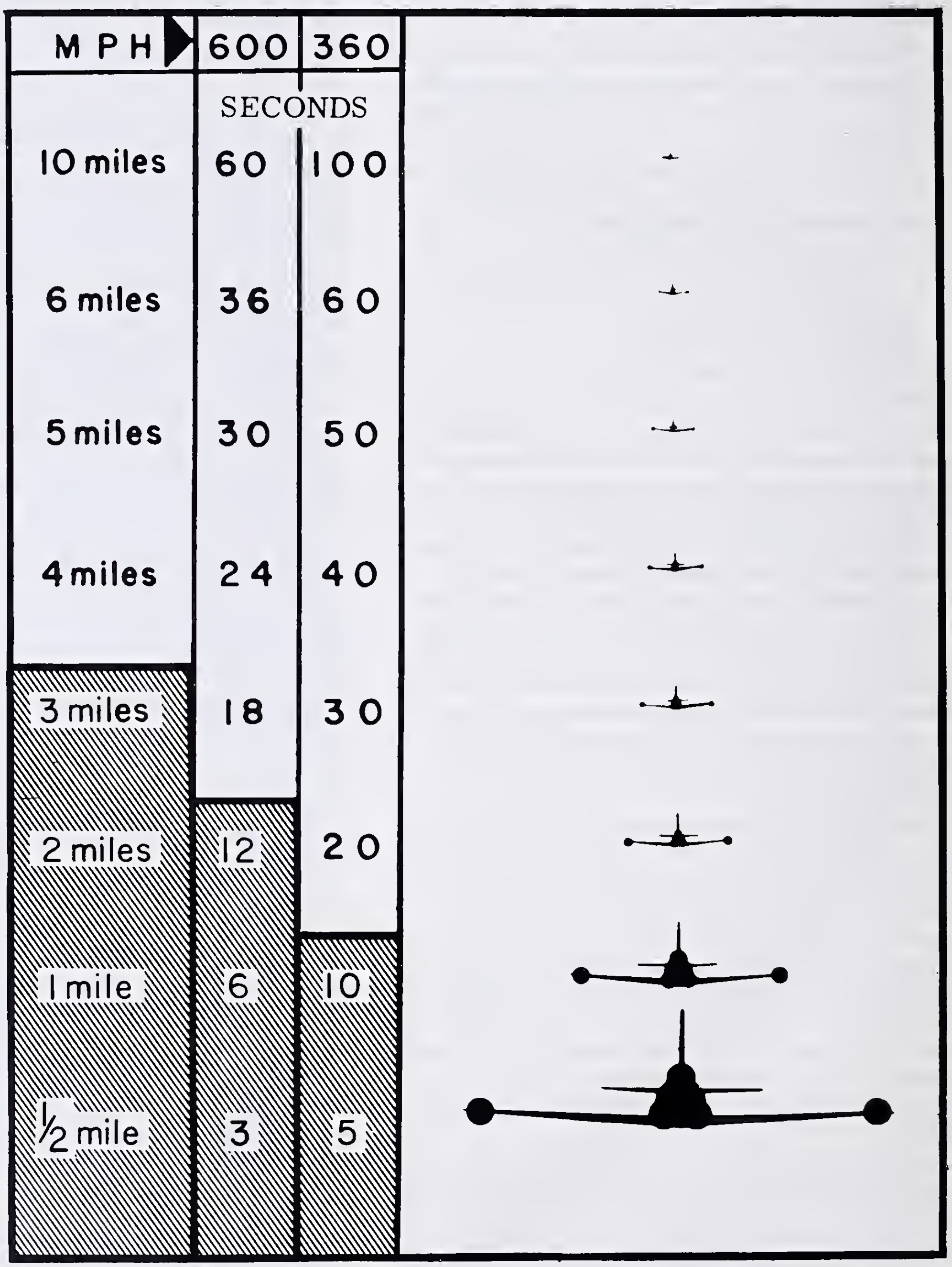
Shaping a mental attitude of ourselves has deeper implications than just affecting the mission. It reflects upon the Air Force as a whole by either reinforcing the image of professionalism or eroding it. Our professionalism now, or lack of it, will have a profound effect on each of us years from now. If we continue to promote spirit, pride, and expertise in our Air Force, this legacy will carry on. However, if we fail to maintain these intangible strengths, the future will probably reflect an Air Force void of commitment and dedication. Each of us should evaluate what kind of Air Force we want to have and our part in its quality.

A professional commitment to the mission, to the Air Force, and to the future will continue to provide the edge in a world of strategic "parity." America depends on us to make the difference. Does your "mental toughness" meet the challenge? ★★★

See and avoid concept: Is it effective?

Captain Alvin C. Hoekstra
5th BMW, Minot AFB

DISTANCE - SPEED - TIME



MPH ▶	600	360
	SECONDS	
10 miles	60	100
6 miles	36	60
5 miles	30	50
4 miles	24	40
3 miles	18	30
2 miles	12	20
1 mile	6	10
½ mile	3	5

The rising incidence of near midair collisions has prompted several positive changes by the FAA and the Air Force in an effort to reduce this hazard. Most near-misses and midair collisions characteristically involve a military aircraft flying under IFR that conflicts with a general aviation aircraft operating under VFR. Preventive measures focus on making the general aviation community aware of the areas of intensive military traffic and updating the air traffic control services available. The hazard remains to a large degree, however, and is likely to get considerably worse if the FAA is correct in its prediction that general aviation aircraft activity will double by 1990.

The burden to "see and avoid" still rests primarily with the military pilot. Reasons for this are: the military pilot is usually in the faster aircraft, and therefore, more likely to see the slower aircraft; he is better able to maneuver for evasive action; and he is usually more cognizant of both visual scanning techniques and the intensity of the problem.

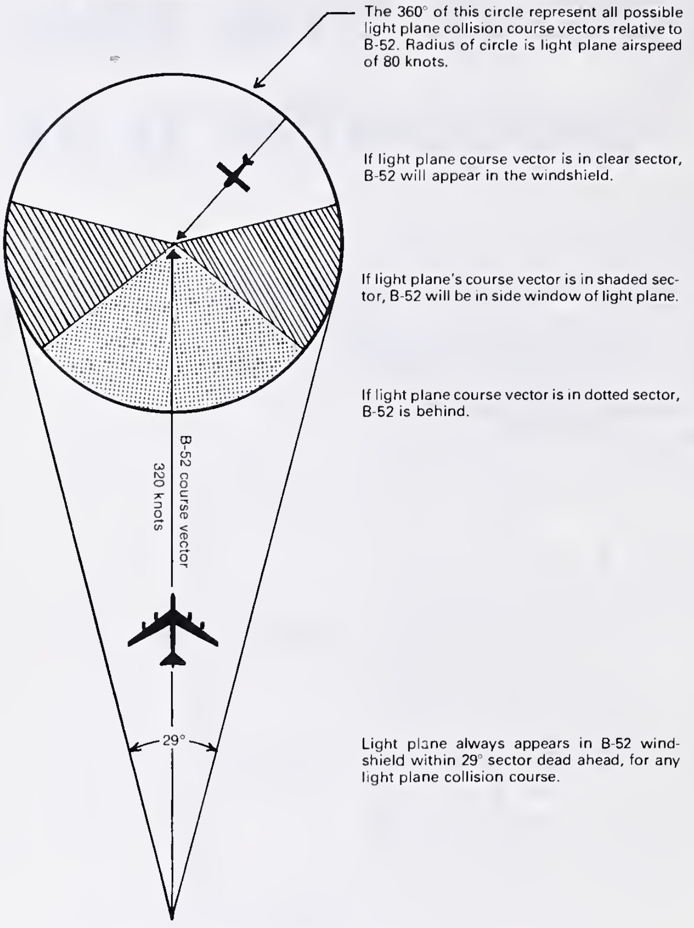
SAC aircrews spend extended periods of time at high speed in areas which are frequented by VFR aircraft. As aircraft speeds approach the limit of human physiological capability to see and avoid, it is essential to understand what good visual scanning techniques involve. For this purpose, I would like to review some information presented in literature and in pilot training concerning three elements of effective clearing. These are: effective clearing techniques; accommodation times (which illustrate the frequency with which airspace must be cleared); and where conflicting traffic is likely to appear in your windscreen.

Two areas of physiological information about vision are essential for the pilot to understand when developing his visual scanning habit patterns. First is that the eyes are essentially lazy. If an effort is not made to look at a distant object, the eyes will focus just outside the aircraft; as a result, the pilot cannot detect an aircraft beyond that point. Secondly, your vision is severely limited (near sighted) in the peripheral area of the

see object	0.1
recognize a/c	1.0
become aware of collision course	5.0
decision to turn left or right	4.0
muscular reaction	0.4
aircraft lag time	2.0
TOTAL	12.5

TIMES TO IMPACT Move back 12 feet from this illustration. From that position the silhouettes represent a T-33 aircraft as it would appear to you from the distances indicated in the table below. The time required to cover these distances is given in seconds for combined speeds of 360 and 600 mph. The gray area on the lower left indicates significant danger for the speeds quoted when aircraft are on a collision course. From U.S. Naval Aviation Safety Bulletin.

Geometry of Collision Courses
(with large speed difference)



The 360° of this circle represent all possible light plane collision course vectors relative to B-52. Radius of circle is light plane airspeed of 80 knots.

If light plane course vector is in clear sector, B-52 will appear in the windshield.

If light plane's course vector is in shaded sector, B-52 will be in side window of light plane.

If light plane course vector is in dotted sector, B-52 is behind.

Light plane always appears in B-52 windshield within 29° sector dead ahead, for any light plane collision course.

field of vision. You can normally detect an aircraft at about four to five miles in the center of the field of vision, but the effective detection range of the eyes in the peripheral area is reduced to about one-half mile. This is well inside the distance required to initiate evasive action. For these reasons, the familiar technique of "focus on a distant object and use definite search patterns" is recommended and should be integrated into your habit patterns.

To help determine what is adequate clearing, a schedule of "times to impact" and a schedule of "recognition and reaction times" is useful. There are numerous factors that affect detection distance (relative motion, aircraft color, size, etc.), but the average maximum distance a light (or fighter type) aircraft can be seen is four to five miles. At the speeds we fly low level, we then have an approximate time of 20 to 30 seconds to see and avoid. See figure 1.

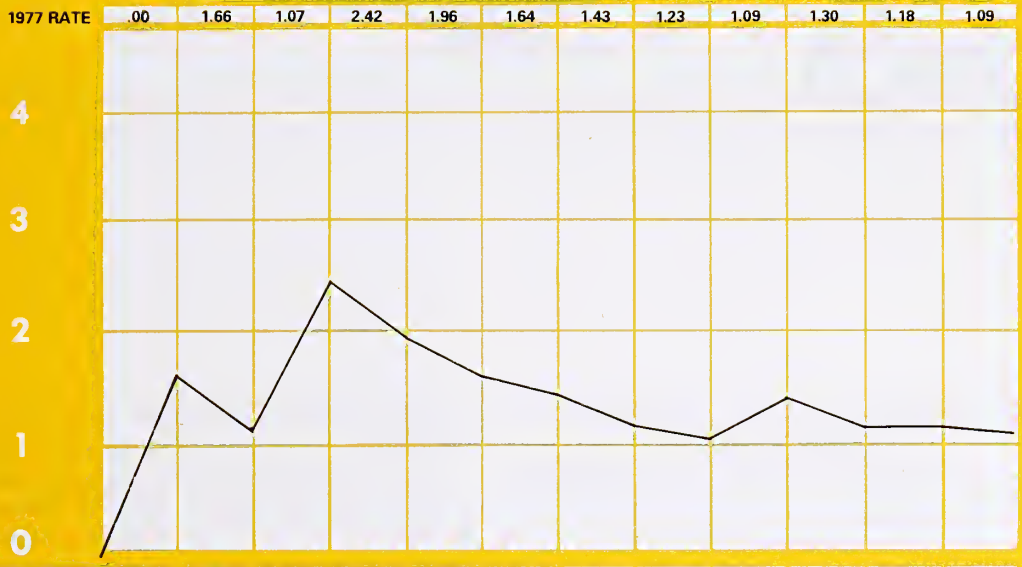
If the 12.5 seconds from the schedule is correct, it then follows that one must clear the appropriate segments of airspace approximately every 10 to 15 seconds. See figure 2. There are several estimates published that are less than the 12.5 second total, but since aircraft like the B-52 have considerably longer lag times than the two seconds cited, it is reasonably correct. To adequately clear then, the effort must become a continuous habit pattern and part of the crosscheck.

An additional factor you should think about is the most likely location in the windscreen that a conflicting aircraft will appear. With this knowledge you can concentrate your scanning primarily in these areas. An excellent treatise of this subject was presented in the November 1977 issue of *Combat Crew Magazine.* See figure 3. This diagram of collision course vectors illustrates all the possible collision courses of a slower aircraft relative to a faster aircraft. It shows that the target will almost always appear near (within approximately 15°) the center of your windscreen. This is the "appropriate segment" and a relatively small area of airspace that should be monitored continually. Climbs, descents and turns require an adjustment to this area of primary emphasis.

A frequent question that comes to mind for anyone involved in high speed VFR flight is whether or not the "see and avoid" concept is a viable means of traffic separation. As mentioned, the speeds at which we fly approach the very limit of the human's physiological ability to see and avoid. You can, however, greatly reduce or improve your own limitations through the degree of vigilance and effectiveness of your visual scanning techniques.

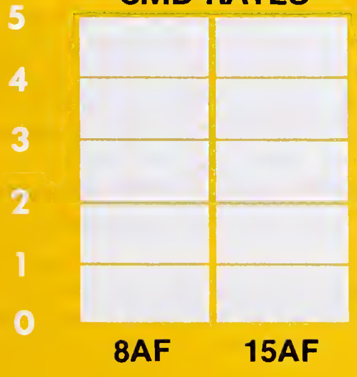
1978 Flying Safety Rate

SAC CLASS A MISHAP RATE (PER 100,000 FLYING HRS)



MISHAPS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1977 RATE	.00	1.66	1.07	2.42	1.96	1.64	1.43	1.23	1.09	1.30	1.18	1.09
1977	0	1	0	2	0	0	0	0	0	1	0	0
1978	0	0	0	0	0	0	0					

1978 SUBORDINATE CMD RATES



LEGEND ⁀ =1977 RATE

MISHAP STATUS

DON'T GET BENT — The Air Force is renowned for writing questions that must be read very carefully to get the proper answer. Try the following question. In which aircraft can you experience the highest cruise altitude?

a. The B-52
b. The KC-135
c. The T-37
d. The Minuteman III

The key phrase in the above question is "can **you** experience." Now the answer is easy: Those of us who fly the T-37 have the distinction, if not the pleasure, of exposing our frail bods to higher pressure altitudes than just about anybody in the Air Force. Flying at 25,000 ft is considered low altitude for a lot of folks. For us, FL 250 is the limit. As in most other things, pressing the limit has its hazards. In this case, you can get the **BENDS.** As a matter of fact, several T-37 crew members have experienced the **BENDS** in the recent past. Each case occurred while cruising at FL 240 or 250 for 20 to 40 minutes. Another similarity in each case was that the bends occurred during the second leg of a cross country. One of the cases involved both pilots in the same aircraft!

Yeah, I know, you've been there and I've been there and neither of us has gotten the bends. Well, there are still several holes in our knowledge of what causes a person to get the bends. What we do know is that low ambient pressure allows dissolved nitrogen to evolve from the blood in the form of small bubbles. If these bubbles work their way into the joints, the result is the bends.

Let's take a two-hop cross country. The first leg we level off at FL 240 and admire the amber waves of grain or the purple mountains majesty for 40 minutes. At the same time, a lot of those little nitrogen molecules start getting together and pretty soon the old circulatory system starts to look like the bandstand at a Lawrence Welk New Year's Eve party. Because we are fairly immobile in the cockpit, nothing happens. Finally, we get an enroute descent, GCA full stop, and we're on the ramp feeling fine. We walk to base ops, update the weather, recycle the morning coffee, get a coke and a candy bar, back to the ramp, preflight the bird, and back to FL 240. All the time we were on the ground those nitrogen bubbles were dissolving back into the blood, right? Wrong! Some were, some were not. Those that didn't were working their way to the joints: elbows, knees, shoulders, and the like. On the ground, these bubbles were so small that they were no problem. Now we're back up here at low pressure on our second leg, and those tiny bubbles have expanded into big bubbles. Remember Boyle's Law?? Anyway, now we've got the Bends and it hurts.

Of course, it wasn't our fault. We were in compliance with all the regs, just unlucky. Maybe, but try this on for size: I did a little flight planning to see if I could prove a point. You might try the same thing and prove it another way depending on the size pencil you use on the charts. I planned a 400-mile leg at 25,000 ft and also at 20,000 ft. I used no wind and a Delta T of +10. To make a long story

ACE TOPICS

short, when I got to the IAF at FL 250 I had 540 lbs, and going at FL 200 I got there with 495. A 45 lb difference. For my money, I'll trade the 45 lbs for a lower altitude rather than taking a chance on getting the Bends.

Just for the record, I'm not suggesting you never go above 20,000 ft. I am saying when you press the limits be sure it's for a valid requirement. There will always be a Monday morning quarterback around (more than likely it'll be your boss) to question your judgment. If you make the decision to go up there because of weather, better winds, or whatever, only do it once a day. If you anticipate needing FL 240 or 250 on the second or third leg of a trip, keep the first and second legs as low as possible. If the bends occur:

a. Get on 100 percent oxygen immediately.

b. Immobilize the affected area.

c. Descend as soon as practical (the sooner the better).

d. Land at the nearest base where suitable medical assistance can be obtained.

Capt Truman E. Wilson
ATC Flight Safety

EMERGENCY PROCEDURE

1. Fingerlift(s) — Raise

2. Throttle(s) — Pull as far aft as possible

The above procedure is an emergency procedure, but it's not the type used to alleviate an emergency. It's the type that creates emergencies when employed at the (im)proper time.

Believe it or not, this procedure has been employed in flight at least twice in the last month. One time it was employed by a saucer-eyed student who suddenly noticed how big some of the terrain features looked during a high speed dive recovery. The second happening served to increase the sales for Grecian Formula Hair Preparation, at least to the IP. This time the student inadvertently applied the emergency procedure too late to allow the instructor to formally declare an emergency. As the aircraft crossed the end of the overrun, the student shut down both engines. There are better ways to see if your instructor is paying attention than to commit him or her to a full-stop, min-run, no-flap landing. Had this occurred a few seconds sooner, you would be reading about it on red-bordered paper.

There are a couple lessons to be learned from these incidents:

1. If you are a student, remember what you are holding in your left hand, and THINK when you move that sinistral member of your body.

2. If you are an IP., never relax. You never know when your student is going to administer a no-notice attention check.

Lt Colonel LeViseur

PROFESSIONAL PERFORMERS

Individuals selected for these pages as SAC's top professional performers of the month are chosen from nominations made by all SAC units. Selection is made only after all nominations have been carefully screened and those chosen meet the highest standards of excellence outlined in SACR 127-2.

MAINTENANCE MAN

As an FB-111A crew chief, Sgt Matheson earned this award for his initiative and outstanding technical competence. Through his efforts, the delayed discrepancies on his aircraft were reduced from over 50 to five. This is significantly below the wing average of 21.7. Another example of his professionalism is the extraordinary Maintenance Standardization and Evaluation Program (MSEP) record he attained. Since his assignment to the unit in March 1973, Sgt Matheson has had 20 evaluations, 11 of which were rated excellent, including three by the SAC MSET. He was also awarded the Master Crew Chief Award. He shares his expertise by acting as a trainer for newly assigned personnel. His ability to communicate with others and his leadership qualities have made him invaluable in this area.

Sgt Richard G. Matheson, 509 OMS, Pease AFB.

TITAN Crew S-032, 381st Strategic Missile Wing, McConnell AFB: MCCC 1Lt Terry G. Cook, DMCCC 1Lt John J. Fraser, MSAT SrA Michael F. Gremillion, and MFT Sgt Daniel M. Hainline.

TITAN

The professionalism exhibited by each crewmember enabled them to react in a cool, calculated manner during hazardous situations. For example, during the Phase III Extended Life Program, the complex would not come out of post attack. Reacting quickly and positively to the only indication they had, an increase in the silo temperature, the crew retraced maintenance actions and discovered a temperature controller was set 40° warmer than prescribed by available technical data. Their swift and accurate troubleshooting saved an imminent missile degradation and returned the complex to normal operations. Crew S-032's proficiency was also demonstrated during a multiple hazard situation on a recent alert. With minimum delay and without undue exposure to danger, the crew determined the proper reaction and successfully handled a fire and two vapor hazards. Their actions prevented possible serious injury to personnel on complex and further damage to equipment.

MINUTEMAN Crew R-071, 341st Strategic Missile Wing, Malmstrom AFB: MCCC 1Lt Richard Minerley, and DMCCC 2Lt James McCormick.

MINUTEMAN

During their first alert at Fox Launch Control Center, Crew R-071 displayed outstanding professionalism under stress. The crew was presented with complex status at the changeover briefing. A Polo Hat exercise was in progress; F-01 had a VHF radio outage; a maintenance team was working topside; the squadron Hardened Voice Channel was in an abnormal configuration due to maintenance; and F-07, opened for maintenance, presented an unusual situation. Two different teams were jointly fulfilling a security requirement, and two other teams were jointly fulfilling the two-man policy requirements. During the next six hours, the Polo Hat exercise was terminated and the LCC was returned to normal configuration after two maintenance teams were released. Crew R-071 was notified of the requirement for the squadron to enter Anti-Jam for test purposes, and at this time the team chief on F-07 reported that a leaky air conditioner line had sprayed liquid on the first stage of the missile. Crew R-071 declared a possible "wet missile" hazard and directed coordination with the team chief, wing job control, and wing command post using the contingency checklist. Working as a team, Lt. Minerley monitored the "wet missile" hazard while exiting the Anti-Jam mode and Lt McCormick processed various teams on F-07 for the "wet missile" inspection.

Blank pages

continued from page 11

"OK," I returned. "Crew, this'll be a full stopper. Time to quit."

"Pattern speeds?"
"Computed!"
"Landing Gear?"
"Checked Down!"
"Fuel panel?"
"Set!"
"Set 30°!"

Things were going smooth. For some reason though, the airspeed was 10 knots high for my normal power setting. I shrugged it off, and pulled back the power slightly. We continued around the pattern to final approach.

"Checklist complete," called the IP. I checked around the cockpit again to make sure everything was in its proper place. The airplane continued to use less power than I had been using, but I finally chalked it up to "bad lift in the air." As I began to flare the aircraft for a landing and pulled the throttle back, I began to get an annoying beeping in my headset. I scanned the electrical panel, the engine instruments, and flight instruments before I saw the landing gear handle.

At that instant, that handle became the only thing on the front panel. My vision tunneled to the plastic wheel at the end of the shaft. In a split second, the two-inch diameter wheel had grown to the size of a medicine ball. The red warning light was on, and the handle was in the up position. From there it was like a slow motion dream. My mind was screaming "Go Around!" but my hand weighed a ton. The engine noise, the static in the headset, even the beeping were suddenly silent, though I knew they were still there. I could hear only my heart beat and it wasn't moving in slow motion. After what seemed an hour, I applied full power and we scooted down the runway several feet from disaster.

What had happened to the gear? I had the checklist on my leg and referred to each item as we came to it — but I never **saw** that each item was accomplished. That checklist was as good as a blank page!

You might fault my cocky attitude. Possibly fatigue, or even complacency by the IP in the right seat, or copilot in the jump seat was at fault. An accident board might cite a break in a set routine as the cause. I think they all were contributing factors.

I still shiver to think how close I came to an accident. Since then, I've developed what I call the "dirty old man" technique. I grab, pinch, and squeeze everything I can reach. A switch that has to be moved or checked will feel a shove even if it's already in the proper position.

I still have my fetish for complete stories, and hopefully I've eliminated blank pages from my checklist. At least I haven't tried to make another gear up landing. — Anon.

Continued from page 7

DANGER AREA...

cause a further breakdown of the "see and avoid" concept.

A 1974 study by the Mitre Corporation for the FAA listed the most significant contributing factors to IFR-VFR midair and near midair collision as:

1. No surveillance data on the other aircraft.
2. No altitude data on the other aircraft.
3. ATC responsibility split between two controllers.
4. Pilot/crew factors.

$$(NMAC = V_t^2) = (E=T^2)$$

A theoretical formula developed from the Journal of the Institute of Navigation shows that: The potential for near midair collisions is squared as the volume of traffic in a given area increases or $NMAC = (\text{Vol. of Traffic})^2$. This means that if the air traffic doubles, the number of near midairs will be multiplied by four.

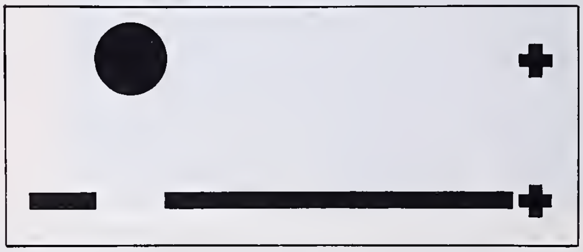
Air traffic is forecast to continue to increase. Although military operations are expected to remain relatively stable, the rise in general aviation activity may be substantial.

The message is clear, if we are to avoid an increase in midair collisions in the future, our efforts must also be increased in proportion to the square of the traffic $E=T^2$.

IN CONCLUSION

An airman is more likely to detect an aircraft . . .

- the larger it is.
- during daylight, the closer it falls on the center of vision, during evening, detection may be better if the image falls on the peripheral retina (off center).
- the more it contrasts with its background
  —in brightness; ex. a dark aircraft against a white cloud.
  —in color; a yellow airliner against a blue sky.
  —in shape; ex. a side view of an aircraft rather than a head on view.
- the more adapted the eyes are:
  —adaption to light takes about 10 minutes from darkness to moderate lighting.
  —adapting to dark takes at least 30 minutes, from bright sunlight to darkness.
- generally the faster the aircraft moves, however, very fast aircraft cannot be clearly recognized.
- the greater the change in aircraft speed
  —the less the head and eyes move (rapid scanning reduces the ability to discern the aircraft's relative motion.
  —the longer the aircraft remains in the field of view.
- Know the limitations of radar.
- Help controllers in helping you.
- Realize the VFR/IFR mix situation.
- Know where high traffic density areas are located.
- Along with "looking", "listen".
- The majority of midairs and near midair occur: near the airport, during day VFR weather and usually below 8,000 feet AGL.
- As the volume of traffic in a given area increases, the potential for a midair is squared; $NMAC=(\text{Volume of traffic})^2$.



LOCATING THE BLIND SPOT

A. With the right eye closed, look at the right of the upper figure. Move the paper back and forth about one foot from the eye; the circle on the left will disappear. At that point it is projected on the blind spot.

B. With the right eye closed, look at the cross at the right of the lower figure. When the white space falls in the blind spot, the black line appears to be continuous. This phenomenon helps to understand why we are not ordinarily aware of the blind spot.

It is important to realize that all of us have a blind spot. The potential for a midair collision lies within this blind spot area. At one mile this area could be 800 feet by 500 feet and at 5 miles the area may be 4/5 of a mile. The blind spot will vary as to different types of aircraft and different face structures. A way to compensate for the blind spot is to move the head around while looking and look more than once in a given direction.

ABOUT THE AUTHOR

Captain Kassen received his commission in 1967 through AFROTC after graduation from Ball State University (MA from Texas Christian University). After completion of UPT in 1969, his assignments have included a tour in C-7A's at Vang Tau RVN, three years as a KC-135 pilot and one year as a B-52G pilot at Loring AFB, and a 15 month tour at Andersen AFB. Captain Kassen is presently assigned as Flying Safety Officer for the 7BMW, flying as an Instructor Pilot in the B-52D.

SAC SAFETY SCREEN

43 SW, Andersen Crew E-06: P Capt Thomas W Phelps, CP Capt Thomas G Miller, RN Capt Henry Childs, N 1Lt Forrest P Smith, EW Capt James R. Westmoreland, G A1C Leonard J Lombardi

43 SW, Andersen Crew S-01: P Capt John G Lawton III, CP Capt Regner C Rider, RN Capt John F Reilly, N Capt William A Heath III, EW Capt Michael D Masterson Jr, G MSgt William W Replogle

44 SMW, Ellsworth Crew R-193: MCCC 1Lt James L Velez, DMCCC 2Lt Larry W Ross

55 SRW, Offutt Crew E-13: P Capt Robert H Woodmansee, CP Capt Wayne T Nearing, N1 Capt William A Isner, N2 Capt Scott W Amelung

70 AREFS, Grissom Crew E-188P: P Capt Bryce L Bramsen, CP Capt Jay R Barr, N Capt Craig D Voss, BO TSgt Jerry L McGee

90 SMW, F E Warren Crew R-023: MCCC Capt Edward L Searlees II, DMCCC 1Lt Don J Bernardini

91 AREFS, McConnell Crew E-113: FP Capt Gary T Talucci, CPX Capt Nicholas S Cristiano, CPY 1Lt William A Eason, NN 1Lt Gary A Riegel, BO Sgt Larry D Townsend

92 BMW, Fairchild Crew E-113: P Capt Benjamin F Miller, CP Capt Wayne N Harris, N Capt Bradley J Kight, BO SSgt William C Randal

96 BMW, Dyess Crew E-21: P Maj Julio A Echegaray, CP 1Lt Bruce A Richardson, NB Capt George R Gray, NN 1Lt Robert E Bailey Jr, IE Capt Edward P Grant, AG Amn Gregg A Ackley

301 AREFW, Rickenbacker Crew R-113: P Capt John P Vallier, CP Capt William F Balas, N 1Lt Randy D Barker, BO Sgt Randy V Price

301 AREFW, Rickenbacker Crew R-110: P Capt Charles L Ferguson, CP 1Lt Ronald L Paulding, N Capt Timothy R Taylor, BO A1C John C Snelgrove

305 AREFS, Grissom Crew E-114: P Capt William R Spaulding Jr, CP Capt Lawson T Holmes Jr, N 1Lt David L Wilson, BO Sgt Carl R Buch

308 SMW, Little Rock S-199: MCCC Capt John Dumond, DMCCC 1Lt Thomas G Stavropoulos, MSAT SSgt Dennis W Black, MFT SSgt James E Van Cise

310 AREFS, Plattsburgh Crew E-167: AC Capt David A Wagle, CP Capt John F D Armstrong, N Capt William A Ady, BO Sgt Michael L Wetzel

320 BMW, Mather Crew S-103: P Capt James F Segal Jr, CP 1Lt Richard C Orellana, N Capt John T Sherkus, BO TSgt Thomas E Glenister

321 SMW, Grand Forks Crew S-111: MCCC 1Lt John M West, DMCCC 1Lt Michael G Borders

351 SMW, Whiteman Crew S-004: MCCC Capt Rodney C Allison, DMCCC 1Lt Richard A Kniseley

380 AREFS, Plattsburgh Crew E-123: AC Capt Arthur Lichte, CP Capt Tom Caperton, N 1Lt Charles Beadling, BO A1C Don Weiler

384 AREFS, McConnell Crew E-160: AC Capt Joseph R Johnson, CP 1Lt Gregory J Doutel, N 1Lt Booker T Roy, BO SSgt Charles W Bogda Jr

528 BMS, Plattsburgh Crew E-18: AC Capt James H Ferrell, IP Capt George Davies

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HALL OF FAME

TACTICAL FLYING

OVER TWENTY-TWO YEARS

170 AREFG, McGuire (NJANG)	NONE

OVER TWENTY YEARS

171 AREFW, Greater Pittsburgh (PAANG)	Mar '58
157 AREFG, Pease (NHANG)	Jun '58

OVER NINETEEN YEARS

97 BMW, Blytheville	Aug '58
940 AREFG, Mather (USAFR)	May '59

OVER EIGHTEEN YEARS

307 AREFG, Travis	Sep '59

OVER SEVENTEEN YEARS

19 BMW, Robins	Oct '60
151 AREFG, Salt Lake City (UTANG)	Feb '61
161 AREFG, Sky Harbor (AZANG)	Apr '61
126 AREFW, Chicago O'Hare (ILANG)	Apr '61

OVER SIXTEEN YEARS

134 AREFG, McGhee Tyson (TNANG)	Aug '61
340 AREFG, Altus	Feb '62
301 AREFW, Rickenbacker	Jul '62

OVER FIFTEEN YEARS

96 BMW, Dyess	Aug '62

OVER THIRTEEN YEARS

160 AREFG, Rickenbacker (OHANG)	Dec '64
320 BMW, Mather	Jul '65

OVER ELEVEN YEARS

452 AREFW, March (USAFR)	Sep '66
92 BMW, Fairchild	Feb '67
55 SRW, Offutt	Jul '67

OVER TEN YEARS

2 BMW, Barksdale	Aug '67
319 BMW, Grand Forks	Dec '67
22 BMW, March	Feb '68

OVER NINE YEARS

5 BMW, Minot	Feb '69

OVER EIGHT YEARS

42 BMW, Loring	Sep '69
141 AREFW, Fairchild (WAANG)	Oct '69
28 BMW, Ellsworth	May '70

OVER SIX YEARS

7BMW, Carswell	Mar '72
101 AREFW, Bangor (MEANG)	Mar '72
416 BMW, Griffiss	May '72

OVER FIVE YEARS

305 AREFW, Grisson	Aug '72
376 SW, Kadena	Nov '72
379 BMW, Wurtsmith	Apr '73

OVER FOUR YEARS

384 AREFW, McConnell	Mar '74
189 AREFG, Little Rock (ARANG)	May '74

ICBM

OVER FOURTEEN YEARS

381 SMW, McConnell	Nov '63
90 SMW, F E Warren	Jul '64

OVER THIRTEEN YEARS

1 STRAD, Vandenberg	Sep '64

OVER TWELVE YEARS

308 SMW, Little Rock	Aug '65

OVER EIGHT YEARS

341 SMW, Malmstrom	Apr '70

OVER FIVE YEARS

390 SMW, Davis-Monthan	Jul '73

To gain listing in the Hall of Fame, a SAC or ARF unit must be Class A mishap-free for 48 months.